

## Modelling of the thermal treatment process for oil deposit in the carbonate formation

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### Abstract

© 2018, Neftyanoe Khozyaystvo. All rights reserved. The experience of oilfield development shows that at present when oilfields with heavy oils are developed the thermal methods, in particular thermal steam stimulation, have no alternative and have a priority among other methods. The thermal methods are most relevant for development of complex carbonate reservoirs, in which more than 60% of the world's oil reserves are concentrated. However, the recovery factor of the deposit is mostly very low. This is due to the textures complexity of carbonate reservoirs, the high heterogeneity of their composition and physical-chemical properties. Problems of carbonate reservoirs' development are dramatized by high oil density and viscosity of oil. Model experiments with variation of temperature, pressure and composition of the injected heat carrier will allow creating scientific bases of thermal technologies for development of carbonate reservoirs. The paper presents the results of a laboratory study of thermal stimulation of carbonate rock of the oil reservoir. The investigation was carried out on a specially designed flow-type setup equipped by original core holder. The core samples were selected from the Middle Carboniferous deposits of the Republic of Tatarstan. The influence of the composition of steam-gas eluent, temperature, and pressure on the permeability of carbonate rock, the composition both of gaseous thermolysis products and recoverable oil, and the efficiency of oil recovery from the carbonate rock were discussed. A relatively low-temperature (400 °C) decomposition of carbonates initiated by water vapor was established. It was shown that the thermal steam treatment at temperatures up to 500 °C was not accompanied by the destruction of oil components at a pressure of 4,0 MPa in the condensation zone. The most economical and ecological version of the thermal steam stimulation method for the carbonate oil reservoir was proposed.

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### Keywords

Carbonate reservoir, Kerogen, Laboratory bench, Oil composition, Oil displacement, Pressure, Reservoir properties, Temperature, Thermal stimulation, Thermolysis products

### References

- [1] Ibatullin R.R., Technological processes of development of oil deposits, Moscow: Publ. of VNIIOENG, 2011, 304 p.
- [2] Patent no. 2744825 Canada, F22B 1/22, F22B 37/00, F22B 37/52, F22D 7/04, F23J 15/04, F23J 15/06, High pressure direct contact oxy-fired steam generator, Inventor: Clements B.

- [3] Romanov G.V., Semkin V.I., Yusupova T.N. et al., Investigation of the regularities of the thermal behavior of cores of carbonate reservoirs, VINITI deposited manuscript no. 323-V87, 1987.
- [4] Yusupova T.N., Margulis B.Ya., Kotsyubinskiy V.L. et al., Study of the influence of thermal effects on reservoir properties of carbonate rocks by thermal analysis methods, In: "Thermal analysis and phase equilibria", 1987, pp. 9-13.
- [5] Yusupova T.N., Romanov G.V., Ganeeva Yu.M. et al., Destruction of the mineral matrix and the oil fluid caused by steam stimulation of the oil - containing carbonate rock, Proceeding of Conference "GeoConvention 2015 "Geoscience - new horizons", Telus Convention Centre, 4-8 May 2015, Calgary, AB Canada.
- [6] Semkin V.I., Yusupova T.N., Margulis B.Ya., Kotsyubinskiy V.L., Thermal study of carbonate rock in the simulation of vapor-gas impact on the reservoir, Proceedings of X All-Union Conference on Thermal Analysis, Leningrad, 1989, 249 p.